[illegible]

Sensitivity Analysis.

Example :

For the following project under study for the production of a petrochemical product for detergents :

1- The construction of the project will be completed in 3 years, the project needs five years from the start till the full capacity stage (6^{th} year till 15^{th} year).

2- Data about the construction costs, operating costs and volume of sales during installation and operation stages are :

Year	Construction Costs (EGP 1000)	Operating Costs (EGP 1000)	Volume of Sales (1000 tons)
1	150	5	—
2	200	5	—
3	250	10	—
4	—	15	8
5	—	20	12
6 – 15	—	25	20

3- Suggested selling price EGP 10 per ton, and the average interest cost 15% percent.

Required :

(i) Project performance evaluation by DCFRR technique.

(ii) Testing project sensitivity if the selling price is changed from EGP 10 to EGP 8 per ton.

(i)

Values are (EGP 1000)

item \ Year	1	2	3	4	5	6 — 15
Out cash flows :						
Construction costs	150	200	250	—	—	—
Operating Costs	5	5	10	15	20	25
Σ out cash flows	155	205	260	15	20	25
In cash flows :						
Sales income	—	—	—	80	120	200
Net Cash Flow	(155)	(205)	(260)	65	100	175

Starting with 15%

Year	Cash flow × coefficient of present value at 15%
1	$(155) \times \frac{1}{1.15} = (134.85)$
2	$(205) \times \frac{1}{(1.15)^2} = (154.98)$
3	$(260) \times \frac{1}{(1.15)^3} = (171.08)$
4	$65 \times \frac{1}{(1.15)^4} = 37.18$
5	$100 \times \frac{1}{(1.15)^5} = 49.70$
6 – 15	$175 \times \frac{(1.15)^{10} - 1}{0.15\,(1.15)^{10}} \times \frac{1}{(1.15)^5} = 436.53$

NPV = 62.5

∵ NPV is positive

∴ the % rate is more than 15%, we try 18%.

Year	Cash flow × coefficient of present value at 18%
1	$(155) \times 0.847 = (131)$
2	$(205) \times 0.718 = (147)$
3	$(260) \times 0.609 = (158.5)$
4	$65 \times 0.516 = 33.5$

5	100 x 0.437	= 43.7
6-15	175 x 4.494 x 0.437	= 343.8
	NPV	(15.5)

NPV is negative

∴ the DCFRR is between 15% and 18%

$$\therefore DCFRR = 15\% + \frac{62.5 - 0}{62.5 + 15.5} \times 3\%$$

$$= 15 + 2.4 = 17.4\%$$

The project could be accepted economically because the DCFRR = 17.4% is greater than 15% the average cost of interest rate.

(ii) Testing Sensitivity analysis for the previous project when the selling price is changed to EGP 8 per ton

Cash Flow table (Values in EGP 1000).

Item / Year	1	2	3	4	5	6
Out cash flows :						
Construction costs	150	200	250	—	—	—
Operating costs	5	5	10	15	20	25
Σ out cash flows	155	205	260	15	20	25
In cash flows :						
Sales income	—	—	—	64	96	160
Net Cash flow	(155)	(205)	(260)	49	76	135

To find internal rate of return (True rate of return) or (DCFRR) we try 15%

Year	Cash flow × Discount rate at 15%
1	(155) × 0.870 = (135)
2	(205) × 0.756 = (155)
3	(260) × 0.658 = (171)
4	49 × 0.572 = 28
5	76 × 0.497 = 38
6_15	135 × 5.019 × 0.497 = 337
	NPV (58)

∵ NPV is negative

∴ the expected rate is less than 15%, we try 12%

Year	Cash flow × D. rate at 12%
1	(155) × 0.893 = (138.42)
2	(205) × 0.797 = (163.39)
3	(260) × 0.712 = (185.12)
4	49 × 0.636 = 31.16
5	76 × 0.567 = 43.09
6_15	135 × 5.560 × 0.567 = 432.5
	NPV 19.8

∵ NPV is positive

the TRR or DCFRR is between 15% and 12%

$$DCFRR = 12\% + \frac{19.8 - 0}{19.8 + 58} \times 3\% = 12 + 0.8$$

$$= 12.8\%$$

Sensitivity analysis for decreasing the selling price EGP 8; the DCFRR is decreased from 17.5% (more than 15%) to 12.8% (less than 15). So the project is very sensitive to changes in selling price and changed from ecomically accepted to be rejected if the selling prices are decreased.

القيمة المضافة : Added value

وتعرف بأنها الفرق بين قيمة المنتج وقيمة ما يلزم لإنتاجه من خامات raw material ومواد مساعدة auxiliaries (ماء - كهرباء) وكيماويات إضافية.
القيمة المضافة هنا تستخدم بشكل واضح للحكم على الكفاءة الصناعية لكثير من المشروعات فإنها تمثل زاوية هامة فيما يدخل على الدخل القومي من تغيير نتيجة تصنيع مجموعة من الخامات بطريقة معينة .

الاحتكار : Monoply

ومفهومه بسيط وهو أن تنفرد هيئة واحدة أو شخص واحد بإنتاج وتوريد سلعة واحدة معينة والمفهوم أن السلعة هو أن منتج له قيمة سوقية وطلب مما يحدد هذه القيمة في وقت ما والمفهوم أن الاحتكار قد يهدف إلى هذا السعر أو إلى كمية السلعة المتداولة وقد ينشأ الاحتكار من جانب واحد وقد تتفق عليه هيئتان أو جانبان ويعرفان هذه الحالات بالاحتكار الثنائي بل قد يكون من عدة جوانب

العائد الداخلي على الاستثمار Internal rate of return (TRR) (DCFRR)

هو المعدل الذي يجعل صافي القيمة الحالية مساويا للصفر أي المعدل الذي يجعل القيمة الحالية لتكلفة المشروع تساوي القيمة الحالية لإيرادات المشروع

Cash Flows

- depreciation is not a cash flow.
- depreciation is simply the accounting amortization of an initial capital cost.
- depreciation amounts are only accounting journal entries.
- depreciation is measured in project analyses only because it reduces taxes

Project Cash Flows: Summary.

Net Cash Flow ≡ Cash Inflow − Cash Outflow

Cash inflows include:

- Cash operating revenues.
- Cash proceeds from selling assets
- Residual value of the investment at the end of its useful life.

Cash outflows include:

- The investment cost (the initial investment).
- cash operating cost
- Increase in working capital

Income tax on taxable income.

The income tax paid is determined by:

$$Taxes \equiv t \times (Revenue - Expenses - Depreciation)$$

Where t is the corporate tax rate. Note that depreciation is not a cash expense and only affects cash flows through its effect on taxes.

Example: Egyptian investors company is considering an immediate investment of EGP 200000 in new equipment. The new equipment is expected to last for 5 years and have EGP 50000 salvage value at the end of its useful life. The annual net cash inflows are EGP 200000 and the annual net cash outflows are EGP 100000. The company's net income is subject to 40% income tax. The company uses the straight-line method in calculating the annual depreciation.

Required: Calculate the annual net cash flows for the new equipment.

Solution

- The annual depreciation $= \dfrac{200000 - 50000}{5} =$ EGP 30 000

- The annual accounting net income $= 200000 - (100000 + 30000)$
  $=$ EGP 70 000

- The annual income tax $= 70000 \times \dfrac{40}{100} =$ EGP 28000

- The annual net cash flows $= 200000 - (100000 + 28000) =$ EGP 72000

These information can be summarized as follows.

Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash inflows Current operating Revenue. Residual Salvage Value	0	200 000	200 000	200000	200000	200000 50000
A - total cash inflows	0	200,–	200,–	200,–	200,00	250,–
Cash outflows: investment cost Current operating cash outflows Income tax	200,000	100,– 28,–	100,– 28,–	100,– 28,–	100,– 28,–	100,– 28,–
B - total cash outflows	200,–	128,–	128,–	128,–	128 –	128,–
	(200 000)	72,–	72,–	72,–	72,–	122 –

Ex.

A corporation is considering installing a machine that costs \$ 60,000 plus installation costs of \$ 2,000. It will generate revenues of \$ 155,000 annually and cash expenses annually of \$ 100,000. It will be depreciated to a salvage value of \$ 6,000 over a seven-year life using the straight-line method. Assuming the firm has a marginal cost of capital of 12% and is in the 34% marginal tax bracket, determine the incremental cash flows of this investment project. What is the annual net cash flow of this project.

Solution

Year 0: The incremental cash flow associated with the project in year 0 are:

Cost of new machine: \$ 60,000 + Installation Cost \$ 2,000 = \$62,000

Years 1-7

Yearly revenues . \$ 155,000

Yearly expenses : \$ 100,000

Yearly tax expenses : = Tax rate × (taxable income)

where taxable income = revenue - expenses - depreciation

D = depreciation is by straight-line method = $\frac{62000 - 6{,}000}{7}$

= \$ 8,000

Yearly tax expenses =

$= 0.34[155{,}000 - 100{,}000 - 8{,}000]$

$= 0.34 \times 47{,}000 = \$\ 15{,}980$

Year 7

Salvage Value = \$ 6,000

Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Cash inflows:	0							
Current operating revenues		155,000	155000	155000	155000	155000	155000	155000
Salvage value								6000
A - Total cash inflow		155,	155,	155,	155,	155,	155,	161,000
Cash outflows: investment cost	62,000							
current operating cash outflows		100,000	100,000	100,000	100,000	100,000	100,000	100,000
Income tax		15,980	15,980	15,980	15,980	15,980	15,980	15,980
B - Total cash outflows	62,000	115,980	115,980	115,980	115,980	115,980	115,980	115,980
Net cash Flows (NCF) A-B	-62,000	39020	39020	39020	39020	39020	39020	45020

(1)

A proposed chemical plant will require a fixed capital investment of \$ 10 million. It is estimated that the working capital will amount to 25 % of the total investment, and annual depreciation costs are estimated to be 10 % of the fixed capital investment. If the annual profit will be \$ 3 million, determine the standard **percent return on the total investment** and the minimum **payout period**. (5 Marks)

Total Capital investment = Working capital + Fixed Capital

$$T.I = W.I + F.I$$

$$T.I = 0.25\ T.I + 10 \times 10^6$$

$$T.I = \$\ 13.333 \times 10^6$$

$$\%\ \text{return on the total investment} = \frac{\text{Average Profit}}{\text{Total investment}} \times 100$$

$$= \frac{3 \times 10^6}{13.333 \times 10^6} \times 100 = 22.5\ \%$$

$$\text{Minimum Payout Period} = \frac{\text{Fixed Capital investment}}{\text{Av. Profit} + \text{depreciation charge}}$$

$$= \frac{10 \times 10^6}{3 \times 10^6 + 0.1 \times 10 \times 10^6} = 2.5\ \text{Years.}$$

A simple conventional chemical plant for producing phenol utilizes highly automated equipment and the total capital investment for the plant is estimated to be £ 700,000. The chosen location for the plant is a property owned by the investor and a high capital is set for the development of such a process. The equipment to be erected included a distillation tower having a diameter of 1 m, vessel overall height 20 m, 30 bubble cap trays, vessel and plates stainless steel and is operated under a pressure of 1 bar. Also, three floating roof carbon steel storage tanks, each having a capacity of 15 m^3 are needed. The rest of the plant equipment costs £ 30,000 at the present time. Corrosive liquids are involved and the equipment is depreciated over 20 years according to the double declining balance method. The plant is operated 24 hours 300 days per year and the product is to be sold at a price of £ 0.5 per liter. The phenol daily production is 12 m^3 and the raw materials cost is £ 220 / m^3 of product. Moreover, 5000 lbs of steam (£ 2 / 1000 lb steam) and 120 KWh electricity (£ 0.08 / KWh) are consumed per 1 m^3 of product. The operating labor per shift is 14 men per shift at £ 1.5 per employee-hour in a plant operating 4 shifts per day. The income tax imposes a 20 % normal tax on the total gross earnings.

Accordingly, estimate the following.

a. Total manufacturing cost for the plant (based on first year operation)

b. Gross earnings and net profit for the plant.

**** Chem. Eng. C.I. = 240** in 1979 and **482** in 2008 (17 Mark

- Cost of distillation column = Cost of Column + plates

$$= (10,000 \times 3.7 \times 1.0) + (190 \times 1.1) \times 30$$

$$= £\ 46690$$

Cost of storage tanks $= C\,S^n = 3000\,(50)^{0.78} = £\ 63433.3$

Scaling down = Cost of tank$_{(15)}$ = Cost of tank$_{(50)}$ $\left(\frac{15}{50}\right)^{0.6}$

$$= 63433.3 \times 0.4856 = £\ 30802.79$$

$$C_{T79} = 46690 + 3 \times 30802.79 = £\ 139098.37$$

$$C_{T08} = 139098.37 \times \frac{482}{240} = £\ 279355.89$$

Total Cost of equipment at (2008) = £ 279355.89 + 30000

$$= £\ 309355.89 \simeq £\ 310000$$

∴ double declining balance depreciation charge (1st Year)

$$2 \times \frac{1}{20} \times 310000 = £\ 31000$$

A simple conventional chemical Plant WCI = 5% FCI

TCI = FCI + WCI = FCI + 0.05 FCI = £ 700,000

FCI = £ 665000

Total manufacture Cost = DPC + IPC

DPC = (variable + Fixed) Cost.

1- Variable manufacture Cost.

Raw material =	220 X 12 X 300	£ 792 000
Utilities : steam	5000 x 12 x 300 x $\frac{2}{1000}$ =	£ 36000
electricity	120 X 12 X 300 X 0.08 =	£ 34 560
Miscellaneous materials :	$\frac{10}{100}$ (Corrosive liquids) (Maintenance)	£ 6650
shipping :	neglected	
		£ 869210

2- Fixed manufacture Cost :

Maintenance =	$\frac{10}{100}$ (FCI)	= £ 66500
Depreciation		31000
Labor :	1.5 X $\frac{24}{4}$ X 14 X 4 X 300	= 151200
Supervision :	20 % Labor	30240
Plant overheads :	50% labor	75600
Insurance	1% FCI	6650
Interest	2% FCI	13300
Royalties		0
Rent :		0
		£ 374490

DPC = Σ V + F = £ 869210 + 374490

= £ 1,243700

(1)

Indirect P C = Sales dis + R&D + General overheads
30 % DPC = £ 373110

Total annual manufacture Cost = 1 243100 + 373110
= £ 1,616 310

Total annual Sales = 0.5 X 1000 X 12 X 300 = £ 1,800000

Gross earnings = Sales - TPC = 1800000 - 1616810
= £ 183190

Net profit = £ 183190 x 0.8 = £ 146552

Cash flow = Net profit + depreciation charge
= 146552 + 31000 = £ 177552

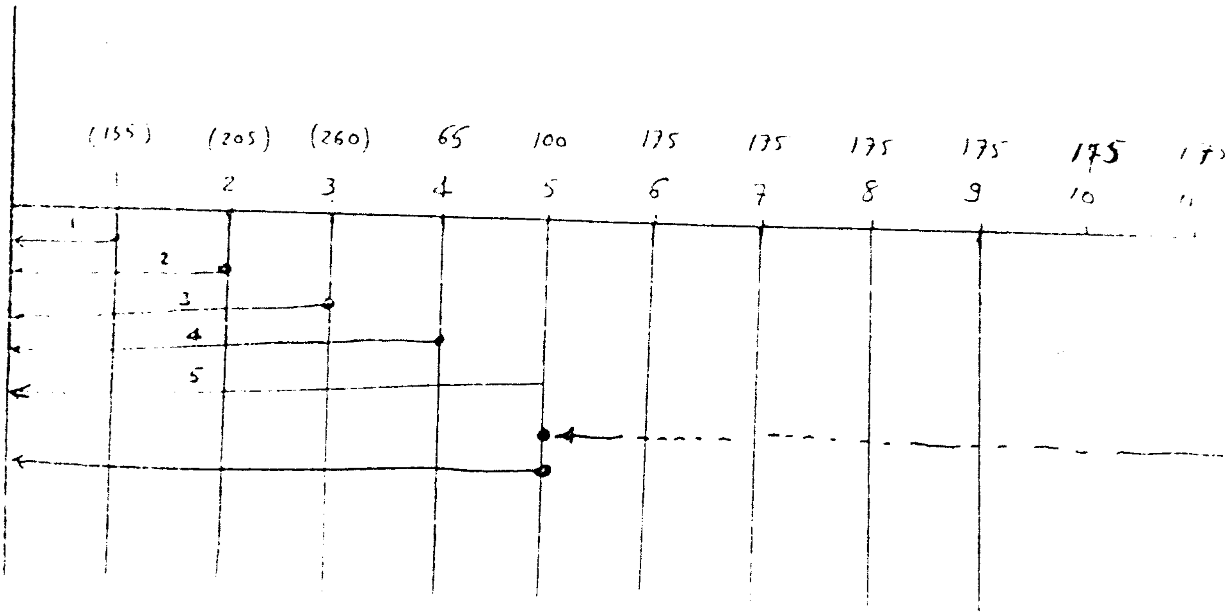
$$ROI = \frac{146552}{700000} \times 100 = 20.936\ \%$$

$$\text{Pay back period} = \frac{665000}{177552} = 3.745 \text{ Years}$$

Consider the following project under study for the production of a product for deter... which the following data apply and the average interest rate is 15 %

Item / Year	1	2	3	4	5	6 - 15
Net cash flow, (Cash flow values are EGP 1000)	(155)	(205)	(260)	65	100	175

It is required to test project performance evaluation by **TRR** (true rate of return) technique.



Starting with 15 %

Year	Cash flow × coefficient of Present Value at 15 %		
1	$(155) \times \frac{1}{1.15}$	=	(134.85)
2	$(205) \times \frac{1}{(1.15)^2}$	=	(154.98)
3	$(260) \times \frac{1}{(1.15)^3}$		(171.08)
4	$65 \times \frac{1}{(1.15)^4}$	=	37.18
5	$100 \times \frac{1}{(1.15)^5}$	=	49.70
6 - 15	$175 \times \frac{(1.15)^{10}-1}{0.15(1.15)^{10}} \times \frac{1}{(1.15)^5}$	=	436.53

NPV = 62.5

NPV is positive

∴ the % rate is more than 15%, we try 18%

Year	Cash flow × Coeffic of Present Value at 18%.
1	$(155) \times \frac{1}{1.18} = (131)$
2	$(205) \times \frac{1}{(1.18)^2} = (205) \times 0.718 = (147)$
3	$(260) \times \frac{1}{(1.18)^3} = (260) \times 0.609 = (158.5)$
4	$65 \times \frac{1}{(1.18)^4} = 65 \times 0.516 = 33.5$
5	$100 \times \frac{1}{(1.18)^5} = 100 \times 0.437 = 43.7$
6 – 15	$175 \times \frac{(1.18)^{10} - 1}{0.18\,(1.18)^{10}} \times \frac{1}{(1.18)^5} = 175 \times 4.494 \times 0.437 = 343.8$
	NPV (15.5)

NPV is negative

∴ IRR or DCFRR is between 15% and 18%.

$$\text{DCFRR or IRR} = 15\% + \frac{62.5 - 0}{62.5 + 15.5} \times 3\%$$

$$= 15 + 2.4 = 17.4\%$$

The project could be accepted economically because the IRR = 17.4% is greater than 15% the average cost of interest rate.